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Title: LOW-POWER-CONSUMPTION MONITOR STANDBY SYSTEM ;

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Inventor(s): KILKINIS DAN (US) ;

Applicant(s): ELONEX I P HOLDINGS LIMITED (GB) ;

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ABSTRACT:

A system for lowering the power output of a video display monitor for a computer during periods of operator inactivity senses the presence or absence of horizontal synchronization (HSYNC) and vertical synchronization (VSYNC) signals, which are normally supplied by the host computer to synchronize data transfer to the video monitor with horizontal and vertical sweep circuitry. Time sensing means at the host senses inactivity, and suspends one or another of the HSYNC and VSYNC signals. Sync sensing and control means in the monitor senses the absence of one or both of the HSYNC and VSYNC signals, and controls power-using circuitry in the monitor in response. In an embodiment applicable to monitors having a microprocessor, the system may be incorporated entirely in software at the host and the monitor. In dumb monitors, the system requires add-in and/or add-on devices cooperating with software. In some aspects random time-periods are generated for timers, and in other aspects parameters for power management are provided to computer stations on a network by a power-management server on the network.

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(71) Applicant:
Elonex I.P. Holdings Limited
London NW2 7LF (GB)

(72) Inventor: Kikinis, Dan
Saratoga, CA 95070 (US)

(74) Representative:
Freed, Arthur Woolf et al
Reginald W. Barker & Co.,
Cliffords Inn
Fetter Lane
London EC4A 1BY (GB)

(54) Low-power-consumption monitor standby system

(57) A system for lowering the power output of a video display monitor for a computer during periods of operator inactivity senses the presence or absence of horizontal synchronization (HSYNC) and vertical synchronization (VSYNC) signals, which are normally supplied by the host computer to synchronize data transfer to the video monitor with horizontal and vertical sweep circuitry. Time sensing means at the host senses inactivity, and suspends one or another of the HSYNC and VSYNC signals. Sync sensing and control means in the monitor senses the absence of one or both of the HSYNC and VSYNC signals, and controls power-using circuitry in the monitor in response. In an embodiment applicable to monitors having a microprocessor, the system may be incorporated entirely in software at the host and the monitor. In dumb monitors, the system requires add-in and/or add-on devices cooperating with software. In some aspects random time-periods are generated for timers, and in other aspects parameters for power management are provided to computer stations on a network by a power-management server on the network.

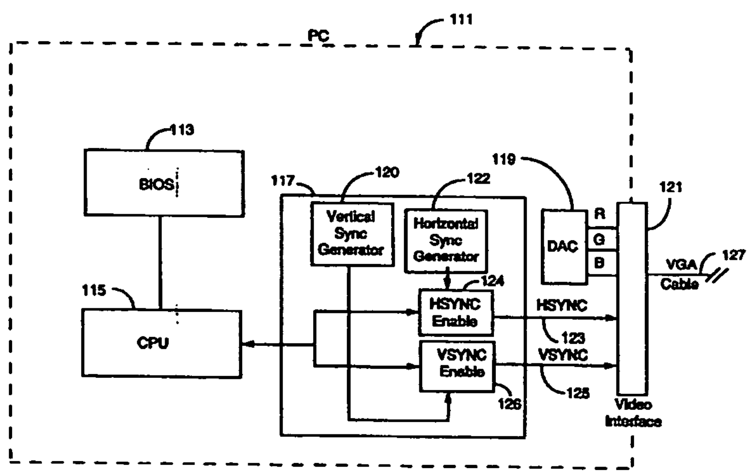

Fig. 1

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Description

Field of the Invention

[0001] The present invention is in the field of automatic power saving devices and pertains in particular to reduction of power consumption by computer video monitors.

Cross-Reference to Related Documents

[0002] Attention is drawn to WO94/12969 and US-A-5,389,952.

Background of the Invention

[0003] A typical color video monitor may consume as much as 50 to 80 percent of the total electrical energy consumed by a personal computer (PC). A video monitor dissipates this energy as visible light emissions from screen phosphors, thermal waste, electromagnetic radiation, high-energy radiation and acoustic energy. Only the phosphor emissions are normally considered useful and then only when actively being watched by an observer. The radiation emissions have been a hotly debated source of concern regarding possible health risks from long-term exposure. Manufacturers incur considerable extra expense to reduce radiation emissions from video monitors. Some people are annoyed by the acoustic emissions produced by some monitors. Thermal losses from video monitors contribute an additional load on air conditioning equipment. The energy efficiency of video monitors has historically improved mostly as a result of advances in the electronic circuit components such as the increased use of integrated circuit (IC) devices. Cathode ray tube (CRT) technology has improved rather little in terms of energy efficiency.

[0004] The number of PC's in regular use is growing rapidly and has reached a point where they have become major consumers of electric power. The United States Environmental Protection Agency has issued power efficiency targets for computer manufacturers to design for in new systems. Low-voltage IC's use less energy, and microprocessor power management techniques allow a computer to reduce energy consumption when idling. Until a suitable replacement for the CRT or a more efficient CRT is developed it will be difficult to substantially improve personal computer energy efficiency.

[0005] What is needed is a way to shut down high-energy-consuming circuits in the video monitor when the computer determines that the display may be of no interest to anyone. This might be determined by a period of inactivity on input devices such a modem, mouse and keyboard. Many computers and video terminals use such a technique to activate a screen blanking circuit or a program that displays moving images (or no image) to avoid burning the screen phosphors. Activating an input device such as pressing a key or moving a mouse causes the previous screen image to be restored. This technique can be extended to reduce video monitor power consumption by signaling the microcontroller found in many recent design monitors, or an add-on device for "dumb" monitors, to shut down or restore some or all of the monitor's electrical power circuits. One key to accomplishing this end is a means of signaling a monitor to shut down to some selected level without adding to the signals presently provided to a monitor.

Summary of the Invention

[0006] In an embodiment of the present invention a system is provided for a general purpose computer having a CPU, a memory means, a monitor, and video signal means for providing horizontal sync (HSYNC) and vertical sync (VSYNC) signals to the monitor, to signal the monitor to assume alternative states. The system comprises timing means for measuring periods of inactivity configured to reset to zero on input interrupts and to provide overflow signals at preset overflow values, and sync disabling means for interrupting at least one of the HSYNC and VSYNC signals to the monitor according to overflow states of the timing means.

[0007] In one embodiment the video signal means comprises video adapter circuitry having a VSYNC generator and an HSYNC generator, and the disabling means comprises a register associated with the video adapter circuitry, wherein one bit in the register is a vertical retrace polarity bit, and another bit is a horizontal retrace polarity bit. The timing means is provided by the CPU following a monitor power management instruction routine stored in the memory means, and SYNC signals are disabled by the CPU writing to the register. The monitor power management routine may be stored in the system BIOS.

[0008] In an alternative embodiment the system is implemented by an add-in time-out controller with sensing means for sensing user input interrupts, and the disabling means comprises at least one switch operable by the time-out controller and placed in a line carrying one of the HSYNC and VSYNC signals. In yet another alternative the system may be accomplished by an add-on (external) time-out controller connected to interface devices at the ports where user input devices are connected. The interface devices monitor input interrupts, and the add-on time-out controller is connected to an interrupt device at the monitor port for interrupting SYNC signals.

[0009] In another aspect the invention involves a CRT monitor configured to respond to power level signals from a host computer. The monitor comprises a SYNC detector for monitoring the presence of VSYNC and HSYNC signals from the host, and power level control means for shutting down power circuitry in the CRT monitor in response.

[0010] In yet another aspect a power system for a monitor is provided with an external SYNC detector placed in the monitor cable to the host. This controller drives a switch that controls AC mains power to the monitor.

[0011] A computer system according to the invention comprises timing means configured to reset to zero on system interrupts, SYNC disabling means for interrupting SYNC signals to a monitor, SYNC detector means associated with the monitor for sensing the presence of SYNC signals at the monitor, and power level control means associated with the monitor for shutting down power-using circuitry in the monitor in response to the presence of SYNC signals.

[0012] In yet another aspect a method is provided for saving power for a video display monitor comprising steps of sensing input interrupts from user operated devices, resetting a timer to zero on receipt of such interrupts, providing a first power level signal to the monitor based on disabling at least one of a VSYNC and an HSYNC signal to the monitor, providing a second power level signal in a different configuration than for the first power level signal, sensing presence of the SYNC signals at the monitor, and shutting down power circuitry in response to the power level signals. A cathode heater is left on for presence of the first signal, and power is shut off completely in response to receipt of the second signal.

[0013] In other aspects of the invention time passage without input for initiating monitor power management may be generated randomly, and in still other aspects, computers may be connected on either a local area or a wide area network a network (LAN or WAN), and different initiation times may be provided for individual ones of connected computers depending on a wide variety of factors, such as time of day and day of the week. In the network management aspect activity at local computer stations may also be monitored by the power management server on the network, and, in the event of inactivity at the computer station beyond a preset threshold, the power management server sends a command to the computer station to enter a power management mode or sequence.

[0014] The present invention in these several aspects provides a way to save power at a monitor, and minimize radiation emissions as well, in response to periods of inactivity, utilizing to a great extent, existing elements and capabilities of a general-purpose computer.

Brief Description of the Drawings

[0015]

Fig. 1 is a largely schematic representation of a PC according to an embodiment of the present invention.

Fig. 2A is a largely schematic representation of a PC enhanced by an add-on device according to an alternative embodiment of the present invention.

Fig. 2B is a largely schematic representation of a PC enhanced by an add-in device according to another alternative embodiment.

Fig. 3 is a largely schematic representation of a microcontroller-based video monitor according to an embodiment of the present invention.

Fig. 4 is a largely schematic representation of a "dumb" monitor equipped with an add-in device according to an alternative embodiment of the present invention.

Fig. 5 is a largely schematic representation of an add-on device for controlling AC primary power to a monitor according to another alternative embodiment of the present invention.

Fig. 6 is a block diagram illustrating a random generator connected to a timer for generating an activation signal for power management according to an embodiment of the present invention.

Fig. 7 is a block diagram illustrating computers connected on a network with a power-management server adapted for providing power management parameters to the connected computers in an embodiment of the present invention..

Description of the Preferred Embodiments

[0016] Fig. 1 shows the functional elements of a preferred embodiment of the present invention capable of providing 3 distinct signals to a monitor to signal the monitor to adjust to as many as three states. In an embodiment of the invention, the states are selected levels of monitor power management (MPM). The signal to the monitor is based on interrupting one or the other or both HSYNC and VSYNC signals. In the embodiment shown in Fig. 1 a PC 111 comprises a Basic Input Output System (BIOS) 113 and a Video Graphics Adapter (VGA) 117. The invention will work equally well with other video adapters, as virtually all such adapters employ HSYNC and VSYNC signals. In some other adapters, equivalent means of interrupting the HSYNC and VSYNC signals would be used.

[0017] BIOS 113 includes instructions for MPM, which can cause a central processing unit (CPU) 115 to change the state of sync-enable controls in VGA 117. In alternative embodiments instructions for implementing MPM might be embedded in operating system (OS) device driver routines or Terminate and Stay Resident (TSR) programs.

[0018] The MPM instructions monitor CPU 115 interrupts for input devices (not shown) such as the timer, keyboard and serial communication ports. MPM instructions advance a time-out counter on each timer interrupt and reset the count to an initial value on each monitored interrupt. The initial value of the MPM time-out counter may be fixed or adjustable. When the MPM time-out counter reaches a pre-set overflow value, due to cessation of monitored interrupts, instructions are executed

that change the state of HSYNC Enable 124 and VSYNC Enable 126 control to disable output of horizontal synchronization signals (HSYNC) 123, produced by horizontal sync generator 122, and/or vertical synchronization signals (VSYNC) 125, produced by vertical sync generator 120, or both. A subsequent monitored interrupt causes execution of instructions that change the state of HSYNC Enable 124 and VSYNC Enable 126 control circuits to enable output of HSYNC 123 and VSYNC 125 signals from VGA 117.

[0019] In the case of a VGA controller, the enable/disable capability is through writing by the CPU into register 3C2 of the controller, wherein bits six and 7 are reserved for horizontal retrace polarity and vertical retrace polarity respectfully. HSYNC and VSYNC signals 123 and 125 are brought to interface 121 along with other signals, such as R, G, and B signals from D/A/converter 119. The signals are transmitted to a monitor on VGA cable 127 as is known in the art.

[0020] In an alternative embodiment, shown in Fig. 2A, useful for refitting existing computers, a current art PC 211 having a CPU 215 is enhanced by installation of a switch 231, which connects between a VGA 217 VSYNC output 225 and VSYNC input 226 to a video interface 221. In a color computer, R,G, and B signals are brought to interface 221 from DAC 219. An add-in time-out controller 229 comprising MPM instructions monitors input device activity as described above for Fig. 1. Time-out of all input devices causes instructions to be executed which change the state of program-controlled switch 231, blocking VSYNC input 225 to video interface 221. Resumption of monitored interrupts causes switch 231 to close, returning the VSYNC signals to line 226. A second switch 232 may be used in the HSYNC line to interrupt the HSYNC signals to line 224, and, in this embodiment, the add-in time-out controller controls both switches. In yet another alternative, one switch may be used to interrupt both HSYNC and VSYNC signals.

[0021] The functional blocks presented in Fig. 2A are an internal solution to an add-in hardware/software embodiment, and the blocks are not intended to be taken literally as hardware devices and interfaces. It will be apparent to one with skill in the art that there are many equivalent ways the functional blocks might be accomplished. The keyboard, mouse, and modem inputs are monitored by the add-in controller, and are made available as well to the CPU in the typical manner.

[0022] Fig. 2B shows an external solution for a hardware/software embodiment. In this solution an add-on time-out controller 259 is external to computer system 233, and each port that supports an input device and the video output port is fitted with an interface device connected to the add-on time-out controller. For example, interface 243 at COM port 241 used for a modem 245 monitors modem activity and reports to controller 259 on line 244. Interface 249 at keyboard port 247 monitors keyboard 251 activity and reports to controller 259 on line 250. Interface 255 at pointer port 253 monitors pointer 257 activity (mouse, joystick, trackball), and reports to controller 259 on line 256.

[0023] In this embodiment controller 259 accomplishes the timer functions and outputs signals on line 238 to interface device 237 at video port 235. Line 239 goes to the monitor. Device 237 interrupts HSYNC and VSYNC signals according to the overflow states of add-on controller 259.

[0024] A color video monitor 347 according to an embodiment of the present invention is shown in Fig. 3. Monitor 347 comprises an interface 333, a microcontroller 339 having MPM instructions according to the present invention and a video circuit (VC) 345 having voltage control circuitry. From interface 333 HSYNC pulses 335 and VSYNC pulses 337 go to microcontroller 339. Microcontroller 339 monitors the HSYNC signal 335 and VSYNC signal 337. The MPM instructions described above count the number of HSYNC pulses occurring between each pair of VSYNC pulses. Zero HSYNC pulses counted causes the MPM instructions in microcontroller 339 to change the voltage on Level-2 signal line 343. Similarly, an interval count of HSYNC 335 pulses greatly in excess of the maximum video scan rate for monitor 347, indicating a loss of VSYNC 337, causes microcontroller 339 to change the voltage on Level-1 signal line 341. Resumption of HSYNC 335 to VSYNC 337 pulse interval counts to a range from the minimum to the maximum scan rate causes MPM instructions in microcontroller 339 to restore quiescent voltage levels to Level-1 signal line 341 and Level-2 signal line 343.

[0025] When video circuit 345 senses an active voltage level on Level-1 signal line 341, it cuts off power to all circuits in monitor 347 except microcontroller 339, any power necessary to interface 333, and video circuit 345 power-control circuits (not shown). In this level 1 standby mode, power consumption of monitor 347 is reduced by more than 90 percent. If monitor 347 remains in level 1 standby for more than a few seconds, full warm-up time is required to reactivate it. An active voltage level on Level-2 signal line 343 causes video circuit 345 to cut off power to all circuits except those described above plus the CRT cathode heater. In level 2 standby mode monitor 347 power consumption is reduced by 80 to 90 percent. Because the CRT is kept hot, reactivating monitor 347 from level 2 standby requires about 5 seconds or less. Reactivation of monitor 347 occurs when voltage on Level-1 signal line 341 and Level-2 signal line 343 returns to the quiescent state allowing video circuit 345 to activate power to all circuits of monitor 347.

[0026] Fig. 4 shows an alternative embodiment of the present invention in a monitor 447 with video circuits functionally similar to those described for the monitor shown in Fig. 3, including an interface 433 and a video circuit 445, but without a microcontroller. A sync detect circuit 451 compares pulse intervals for HSYNC 435

and VSYNC 437 against time-constants of adequate duration to allow for brief interruptions of sync pulses. Loss of HSYNC 435 pulses or VSYNC 437 pulses for periods longer than the associated time-constants causes sync detector circuit 451 to change Level-1 signal line 441 or Level-2 signal line 443 voltage to its active state as described for Fig. 3 and with the same results. Similarly, resumption of HSYNC 435 and VSYNC 437 pulses reactivates monitor 447 as described for Fig. 3 above.

[0027] Fig. 5 shows another alternative embodiment of the present invention suitable for add-on use with a monitor 547 having an interface 533. A sync detect circuit 551, in an external enclosure having pass-through connections, inserts into VGA cable 127. Sync detect circuit 551 monitors video signals on VGA cable 127 and compares the SYNC interval for one or the other of VSYNC and HSYNC to a time-constant in a manner similar to that described for Fig. 4 above. Loss of the monitored SYNC signal in VGA cable 127 for an interval longer than the time-constant causes sync detect circuit 551 to change the voltage on power-control line 561 to its active level, which in turn causes an electronically-controlled switch 553 to open. Electronically-controlled switch 553 controls AC primary power from an electrical cord 559 to a receptacle for monitor 547 power supply cord 557. When electronically-controlled switch 553 opens, AC power to a DC power supply 555 is lost, thus causing total shutdown of monitor 547. Resumption of SYNC signals in VGA cable 127 video signal causes sync detect circuit 551 to change power-control line 561 to its quiescent state, thus causing electronically-controlled switch 553 to close, which restores AC power input to DC power supply 555 reactivating monitor 547.

[0028] In an alternative embodiment of the invention time before initiation of power management is randomly generated. Fig. 6 is block diagram illustrating this situation. Instead of using a predetermined value for counting by the timer before activating a power down stage (first, second or both), a random value is generated for preloading the timer every time on presetting. Referring to Fig. 6, random number generator 611 is connected to timer 613 by a one or more line 615 for providing a preset input, and basic control logic (not shown) is used to control the sequence. The result will be a randomly generated time out, rather than a fixed preset or user preset (predetermined) value.

[0029] In another aspect, illustrated by Fig. 7, computer stations (711a, 711b, 711n) may be interconnected on a network (LAN or WAN) 713 along with a server 715 adapted by MPM application 717 for providing power management parameters to the connected computer stations. A value may be sent or broadcast over the network to either control a time period in response to any parameters, such as environment, time of day, year, random generated numbers etc. It will be clear to the skilled artisan that such timer could exist in the computer, monitor, both or even in the network. Also, it will be clear that implementations can be integrated into ICs as hardware or as firmware, or equivalents may be programmed into software, both in the computer and or the monitor (firmware), as well as in a server on the network.

[0030] In yet another aspect of th_ invention initiation of power management process for one or more computers may be done from a remote computer as a server on a network, such as server 715 of Fig. 7, without the expediency of providing a time period to be timed at the local computer(s). In this aspect server 715 monitors activity at local computers. The local computers may be adapted, for example, to send a periodic report to the power management server. The power management server tracks the periodicity of receipt for local computers, and, when and if a local computer fails to report activity for a certain number of report periods, the power management server sends a command to the local computer to put that computer into power-management mode. The power management program thus initiated may vary widely, from simply shutting of the monitor at the local computer, sending the computer and or the monitor into a suspend or a sleep mode, distinguishing between a multiplicity of modes that might be serially entered by timing at the local computer, and so on.

[0031] In one embodiment involving random generation of time periods, in a computer system having a host computer with a central processing unit (CPU), a memory, input apparatus, and a video monitor, a power management system for managing power usage by the video monitor is provided, comprising a timer dedicated to triggering a power-management routine, the timer having a preset input; a random generator connected to the timer, and adapted to randomly generate count times for the timer in response to a start signal; a signal generator for generating at least one power-management command for the peripheral device; and a power manager circuit in the video monitor. In this embodiment the random generator, in response to the start signal randomly generates a time interval to the timer preset input, and the timer, after the time interval passes, causes the signal generator to send a power management command to the video monitor, and the video monitor assumes a reduced-power state other than off in response to the power management command. In this embodiment the video display may be provided with VGA-standard signals, and the power management command is coded in the VGA-standard signals provided to the video display.

[0032] In another embodiment, in a computer system having a host computer with a central processing unit (CPU), a memory, input apparatus, and a video monitor, a power management system for managing power usage by the video monitor is provided, comprising a timer dedicated to triggering a power-management routine, the timer having a preset input; a random generator connected to the timer, and adapted to randomly generate count times for the timer in response to a start sig-

nal; a signal generator for generating at least one power-management command for the peripheral device; and a power manager circuit in the peripheral device. In this the random generator, in response to the start signal, randomly generates a time interval to the timer preset input, and the timer, after the time interval passes causes the signal generator to send a power management command to the video monitor, and the video monitor assumes a reduced-power state other than off in response to the power management command.

[0033] In yet another embodiment a computer is provided comprising a central processing unit (CPU); a memory connected to the CPU for storing data and instruction routines; input apparatus coupled to the CPU for a user to provide input to the computer; a user input dedicated to starting a random time-period generator connected to a preset input of a timer; and a signal generator adapted for sending at least one power management command to a port adapted for communication with a video monitor. In this embodiment activation of the user input causes the random time-period generator to provide a time period to the timer, and after passage of the time period the timer activates the signal generator to send a power management command to the port adapted to communicate with the video monitor.

[0034] In still another embodiment a method for saving power in operation of a video monitor in a computer system wherein a host computer sends signals to communicate with the video monitor is provided, comprising steps of (a) sensing operation of a start input in a random time-period generator; (b) providing a randomly generated time period to a preset input of a timer in response to the start input; (c) sending a power-management command to the video monitor in response to time out of the timer; (d) detecting the power-management command at the video monitor; (e) signaling power-management circuitry in the video monitor that a power-management command is received; and (f) reducing power to power-using circuitry in the video monitor to a level other than off by the power-management circuitry in response to the signal that a power-management command is received.

[0035] In still another embodiment, in a computer system having a plurality of computer stations connected on a network, each computer station having a host computer with a central processing unit (CPU), a memory, input apparatus, a video monitor, a timer dedicated to triggering a power-management routine, a signal generator for generating at least one power-management command for the peripheral device; and a power manager circuit in the video monitor, a power management system for managing power usage by the video monitors is provided, comprising a power-management server connected on the network; and a Monitor Power Management code set executing on the power-management server. In this embodiment the power-management server provides preset times to the timers in the network-connected computers, and the timers in turn, upon time-out, trigger power management commands to the monitors causing the monitors to assume reduced power states.

[0036] In still another embodiment a method is provided for saving power in operation of a plurality of computer stations connected on a network, each computer station having a host computer with a central processing unit (CPU), a memory, input apparatus, a video monitor, a timer dedicated to triggering a power-management routine, a signal generator for generating at least one power-management command for the video monitor; and a power manager circuit in the video monitor. The method comprises steps of (a) sending preset time periods to individual ones of the computer stations from a power-management server connected on the network; (b) initiating timing of the timers; (c) sending power-management commands to the video monitors in response to time-out of the timers in the computer stations; (d) detecting the power-management commands at the video monitors; and (e) reducing power to power-using circuitry in the video monitor to a level other than off in response to power-management commands.

[0037] In still another embodiment, in a computer system having a computer station connected on a network, the computer station having a host computer with a central processing unit (CPU), a memory, input apparatus, a video monitor, a signal generator for generating at least one power-management command for the video monitor; and a power manager circuit in the video monitor, a power management system for managing power usage by the video monitors is provided, comprising a power-management server connected on the network; and a Monitor Power Management code set executing on the power-management server. The power-management server monitors activity at the computer station, and in the absence of activity beyond a threshold time period sends a command to the computer station to enter a power management sequence.

[0038] In yet another embodiment a method for saving power in operation of a computer station connected on a network is provided, the computer station having a host computer with a central processing unit (CPU), a memory, input apparatus, a video monitor, a power-management routine, a signal generator for generating at least one power-management command for the video monitor; and a power manager system in the video monitor. The method comprises steps of (a) monitoring activity at the computer station by a power management server connected on the network; and (b) in the event of a period of inactivity at the computer station beyond a preset threshold, sending a command from the power manager server to the computer station to enter a power management sequence.

[0039] It will be apparent to one with skill in the art that there are many changes that might be made without departing from the spirit and scope of the inventi n. Some of these alternatives have already been

described, such as MPM instructions implemented in an OS device driver or TSR routines instead of the BIOS, single-level MPM instead of two-level MPM and an external video monitor power control device. Other methods of signaling MPM state changes to a monitor might include time-based coded sequences of frequency changes in HSYNC or VSYNC, coded values in the color signals, or no color signal for an extended period. Alternative embodiments of MPM routines might allow an operator to control MPM operation through command steps, such as menus, dialog boxes or command lines. Such controls might include shutting down monitor power at will by pressing a "hot key", typing a command line or other program interface step. Other features might allow the operator to change the idle time required to trigger MPM and toggle MPM monitoring on or off. Alternative MPM routines might also require an operator to type a password before enabling the transmission of normal video signals to the video monitor. Alternative devices for both built-in and post-manufacture modification to implement monitor power control might be devised. Embodiments of the present invention for monochromatic and gray-scale video adapters and monitors are also contemplated.

Claims

1. In a computer system having a host computer with a central processing unit (CPU), a memory, input apparatus, and a video monitor, a power management system for managing power usage by the video monitor, comprising:

   a timer dedicated to triggering a power-management routine, the timer having a preset input;
   a random generator connected to the timer, and adapted to randomly generate count times for the timer in response to a start signal;
   a signal generator for generating at least one power-management command for the peripheral device; and
   a power manager circuit in the video monitor;
   wherein the random generator, in response to the start signal randomly generates a time interval to the timer preset input, and the timer, after the time interval passes causes the signal generator to send a power management command to the video monitor, and the video monitor assumes a reduced-power state other than off in response to the power management command.

2. A Power management system as in claim 1 wherein the video display is provided with VGA-standard signals, and wherein the power management command is coded in the VGA-standard signals provided to the video display.

3. In a computer system having a host computer with a central processing unit (CPU), a memory, input apparatus, and a video monitor, a power management system for managing power usage by the video monitor, comprising:

   a timer dedicated to triggering a power-management routine, the timer having a preset input;
   a random generator connected to the timer, and adapted to randomly generate count times for the timer in response to a start signal;
   a signal generator for generating at least one power-management command for the peripheral device; and
   a power manager circuit in the peripheral device;
   wherein the random generator, in response to the start signal randomly generates a time interval to the timer preset input, and the timer, after the time interval passes causes the signal generator to send a power management command to the video monitor, and the video monitor assumes a reduced-power state other than off in response to the power management command.

4. A computer comprising:

   a central processing unit (CPU);
   a memory connected to the CPU for storing data and instruction routines;
   input apparatus coupled to the CPU for a user to provide input to the computer;
   a user input dedicated to starting a random time-period generator connected to a preset input of a timer; and
   a signal generator adapted for sending at least one power management command to a port adapted for communication with a video monitor;
   wherein activation of the user input causes the random time-period generator to provide a time period to the timer, and after passage of the time period the timer activates the signal generator to send a power management command to the port adapted to communicate with the video monitor.

6. A method for saving power in operation of a video monitor in a computer system wherein a host computer sends signals to communicate with the video monitor, comprising steps of:

   (a) sensing operation of a start input in a random time-period generator;
   (b) providing a randomly generated time period to a preset input of a timer in response to the

start input;

(c) sending a power-management command to the video monitor in response to time out of the timer;

(d) detecting the power-management command at the video monitor;

(e) signaling power-management circuitry in the video monitor that a power-management command is received; and

(f) reducing power to power-using circuitry in the video monitor to a level other than off by the power-management circuitry in response to the signal that a power-management command is received.

7. In a computer system having a plurality of computer stations connected on a network, each computer station having a host computer with a central processing unit (CPU), a memory, input apparatus, a video monitor, a timer dedicated to triggering a power-management routine, a signal generator for generating at least one power-management command for the peripheral device; and a power manager circuit in the video monitor, a power management system for managing power usage by the video monitors, comprising:

a power-management server connected on the network; and

a Monitor Power Management code set executing on the power-management server;

wherein the power-management server provides preset times to the timers in the network-connected computers, and the timers in turn trigger power management commands to the monitors causing the monitors to assume reduced power states.

8. A method for saving power in operation of a plurality of computer stations connected on a network, each computer station having a host computer with a central processing unit (CPU), a memory, input apparatus, a video monitor, a timer dedicated to triggering a power-management routine, a signal generator for generating at least one power-management command for the video monitor; and a power manager circuit in the video monitor, the method comprising steps of:

(a) sending preset time periods to individual ones of the computer stations from a power-management server connected on the network;

(b) initiating timing of the timers;

(c) sending power-management commands to the video monitors in response to time-out of the timers in the computer stations;

(d) detecting the power-management commands at the video monitors; and

(e) reducing power to power-using circuitry in the video monitor to a level other than off in response to power-management commands.

9. In a computer system having a computer station connected on a network, the computer station having a host computer with a central processing unit (CPU), a memory, input apparatus, a video monitor, a signal generator for generating at least one power-management command for the video monitor; and a power manager circuit in the video monitor, a power management system for managing power usage by the video monitors, comprising:

a power-management server connected on the network; and

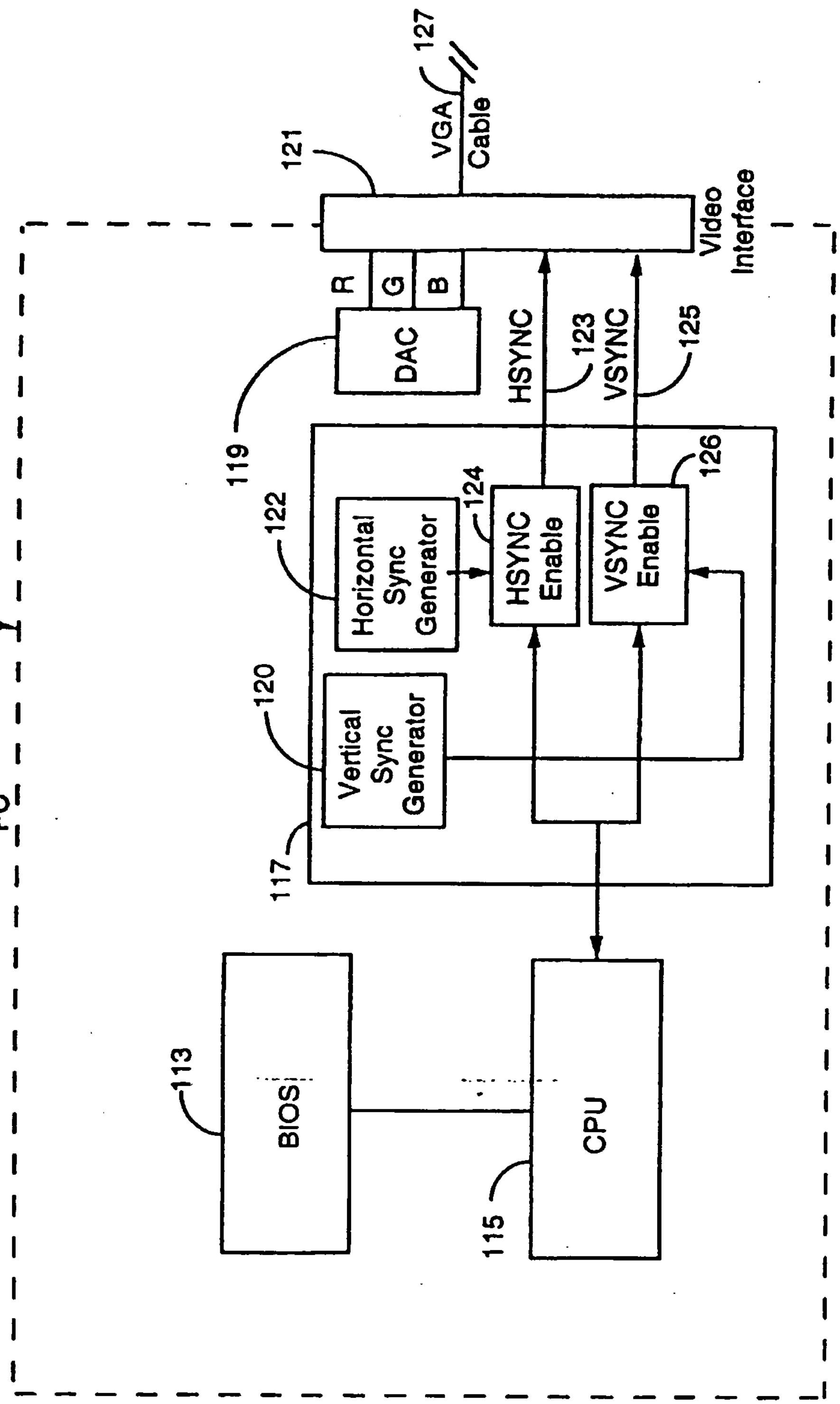
a Monitor Power Management code set executing on the power-management server;

wherein the power-management server monitors activity at the computer station, and in the absence of activity beyond a threshold time period sends a command to the computer station to enter a power management sequence.

10. A method for saving power in operation of a computer station connected on a network, the computer station having a host computer with a central processing unit (CPU), a memory, input apparatus, a video monitor, a power-management routine, a signal generator for generating at least one power-management command for the video monitor; and a power manager system in the video monitor, the method comprising steps of:

(a) monitoring activity at the computer station by a power management server connected on the network;

(b) in the event of a period of inactivity at the computer station beyond a preset threshold, sending a command from the power manager server to the computer station to enter a power management sequence.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BIOS
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CPU
115
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Vertical Sync Generator
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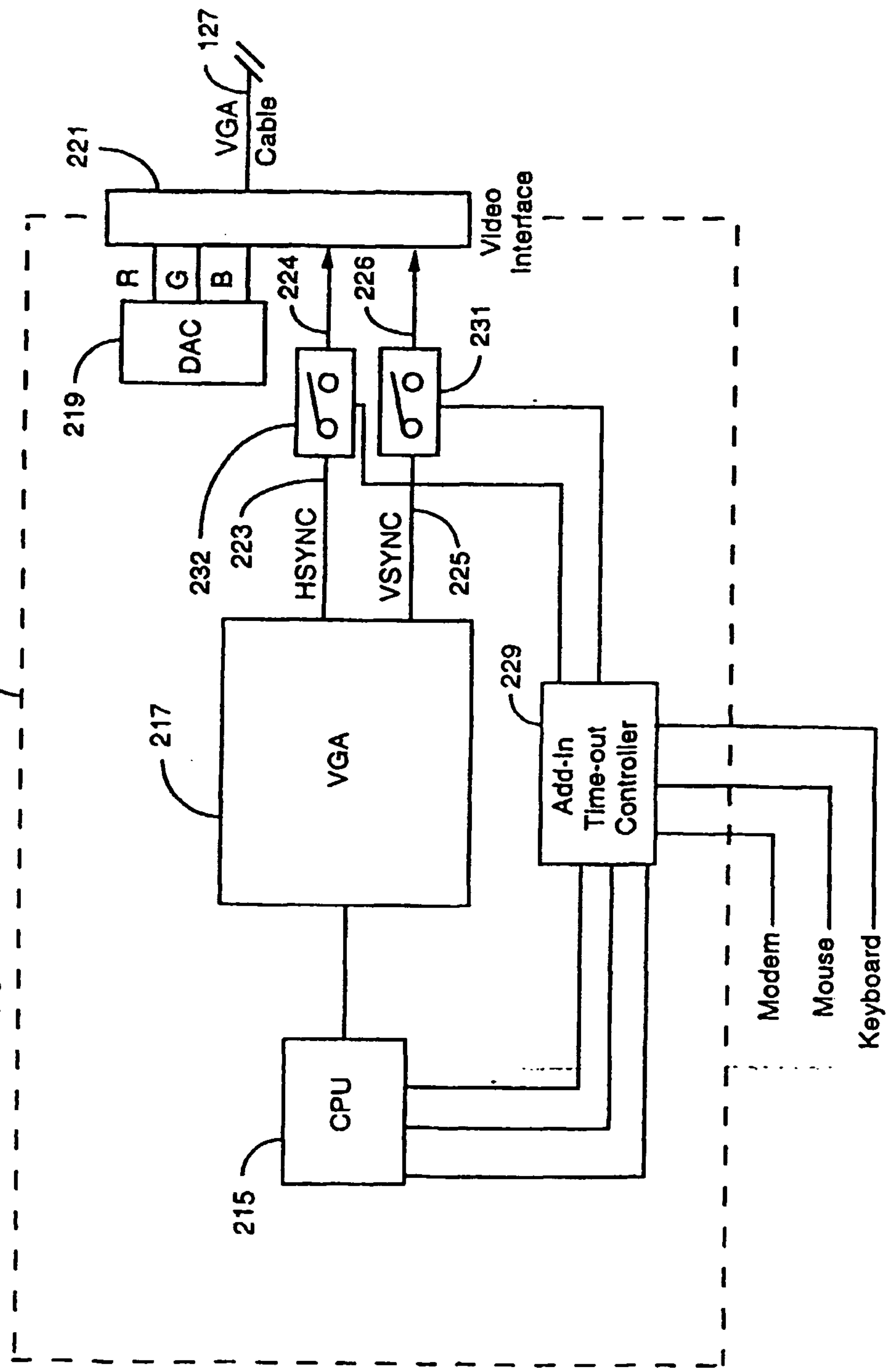
Horizontal Sync Generator
122
HSYNC Enable
124
VSYNC Enable
126
DAC
119
R
G
B
HSYNC
123
VSYNC
125
Video Interface
121
VGA Cable
127

Fig. 1



127
VGA Cable
221
Video Interface
R
G
B
DAC
219
224
226
231
232
223
HSYNC
VSYNC
225
211
VGA
217
229
Add-In Time-out Controller
Modem
Mouse
Keyboard
PC
CPU
215

Fig. 2A

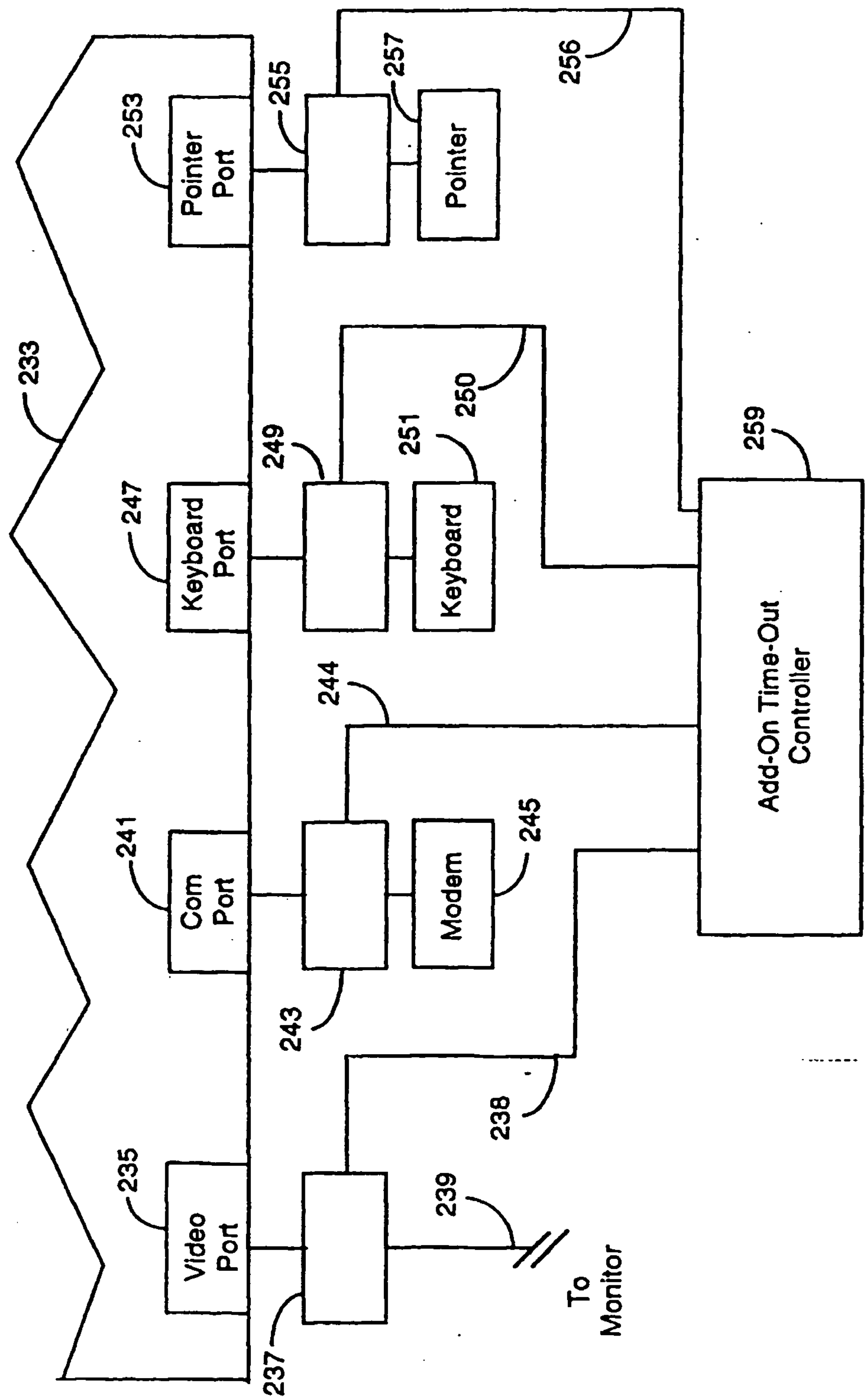

233
253
Pointer Port
255
257
Pointer
256
247
Keyboard Port
249
251
Keyboard
250
259
Add-On Time-Out Controller
244
241
Com Port
Modem
245
243
238
235
Video Port
239
To Monitor
237

Fig. 2B

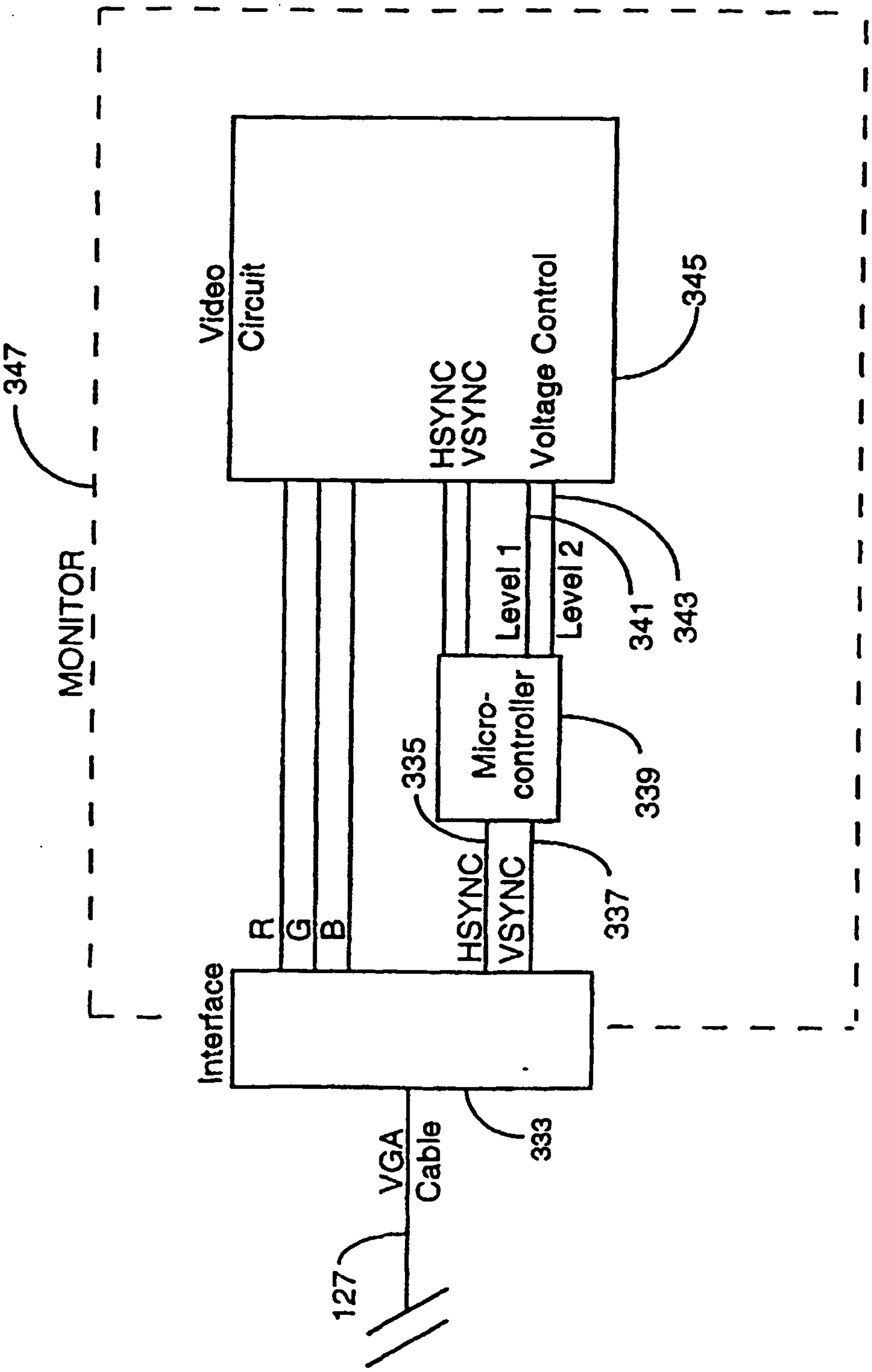

MONITOR
347
Video
Circuit
HSYNC
VSYNC
Voltage Control
345
Level 1
Level 2
341
343
Micro-
controller
339
335
R
G
B
HSYNC
VSYNC
337
Interface
333
VGA
Cable
127

Fig. 3

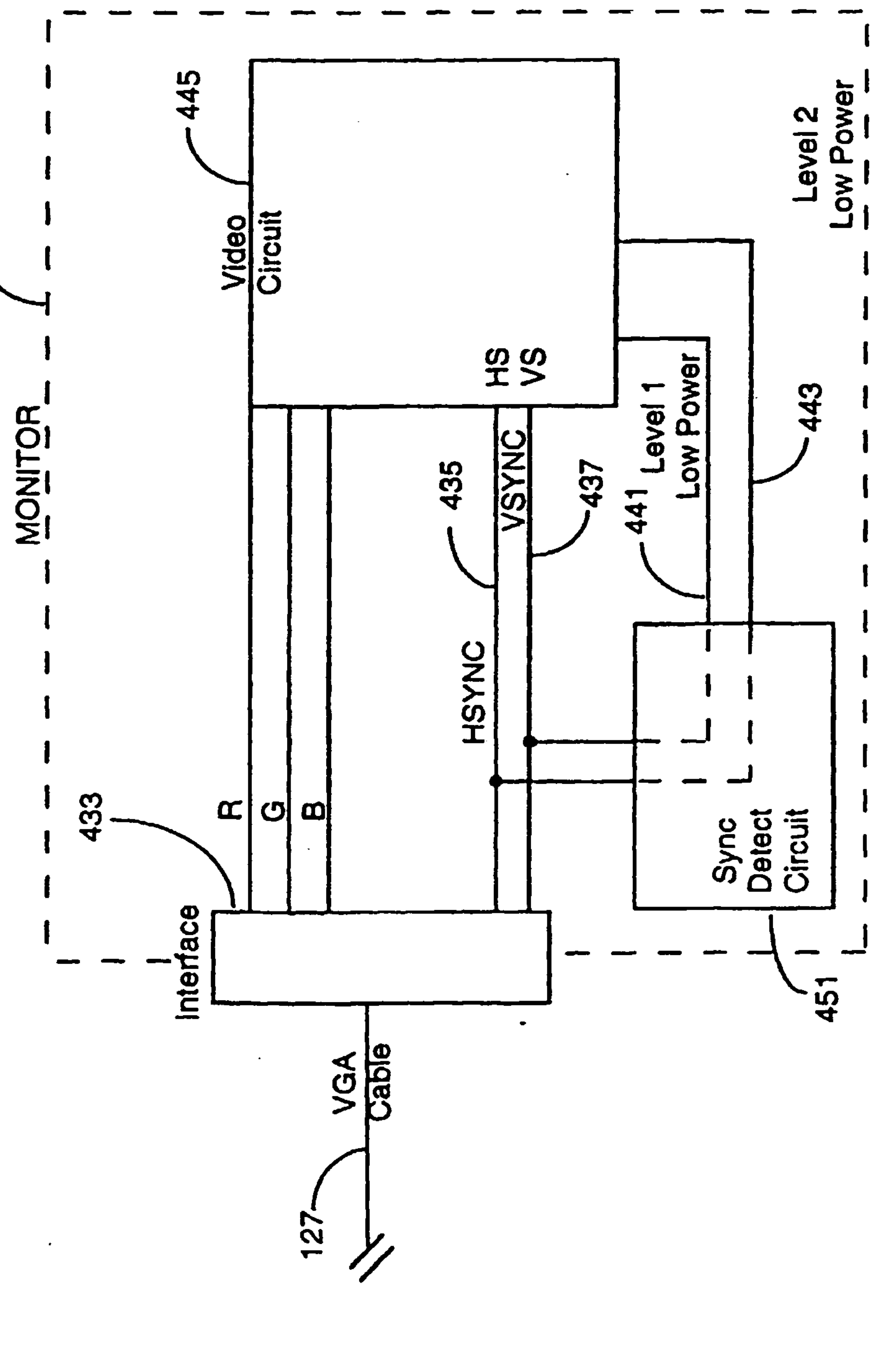

MONITOR
447
Video
Circuit
445
HS
VS
Level 2
Low Power
Level 1
Low Power
443
441
437
VSYNC
435
HSYNC
R
G
B
433
Interface
Sync
Detect
Circuit
451
VGA
Cable
127

Fig. 4

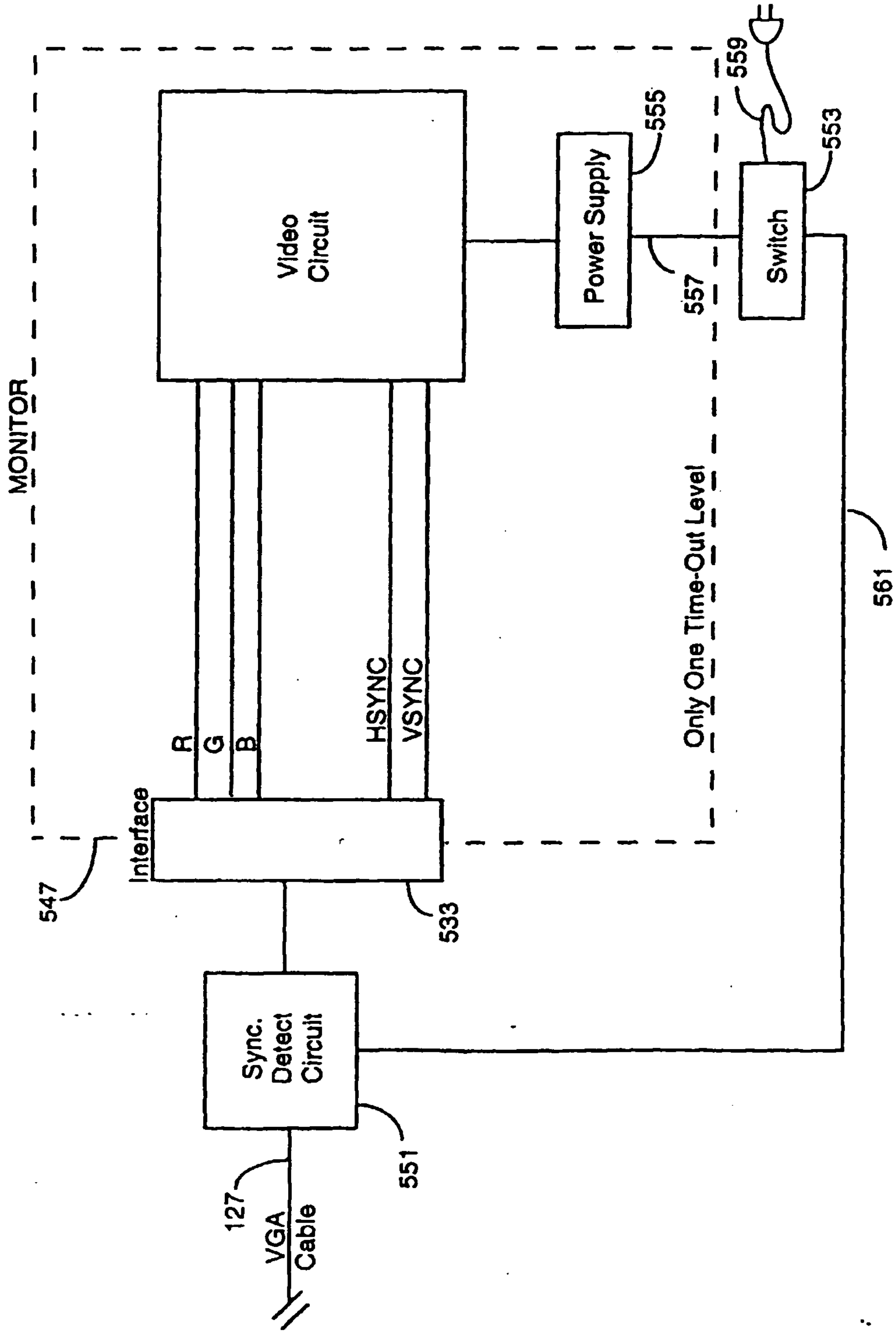

MONITOR
Video Circuit
Power Supply
555
559
553
Switch
557
R
G
B
HSYNC
VSYNC
Only One Time-Out Level
561
Interface
547
533
Sync. Detect Circuit
551
127
VGA Cable

Fig. 5

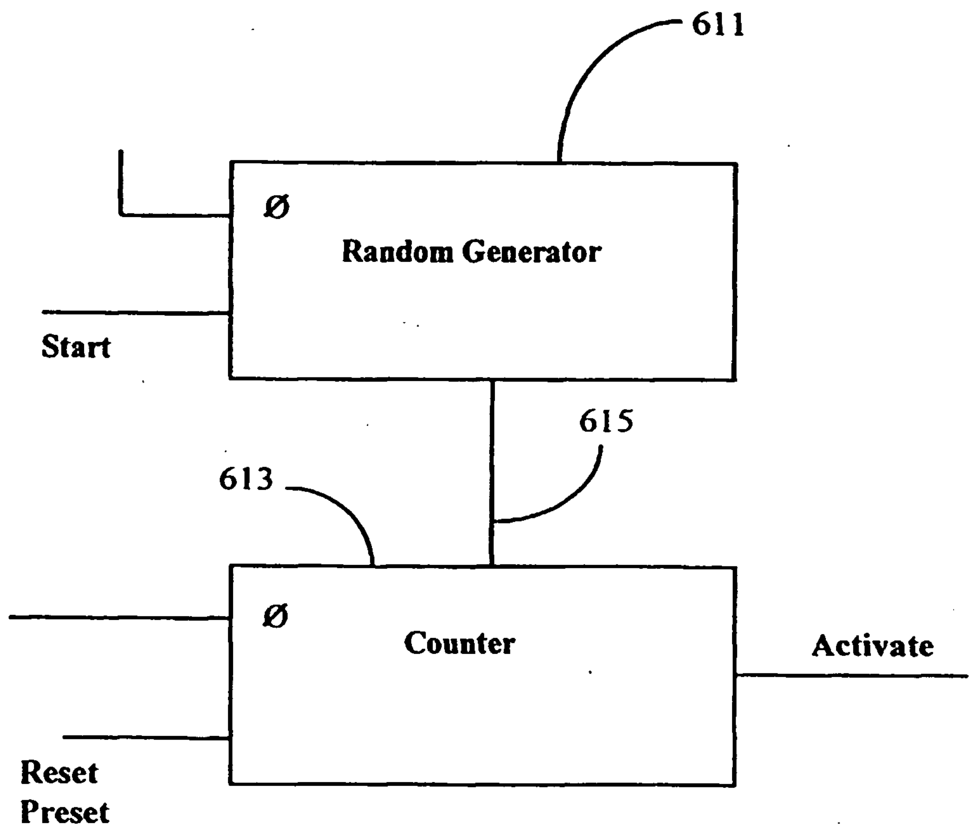

611
Ø
Random Generator
Start
615
613
Ø
Counter
Activate
Reset
Preset

Fig. 6

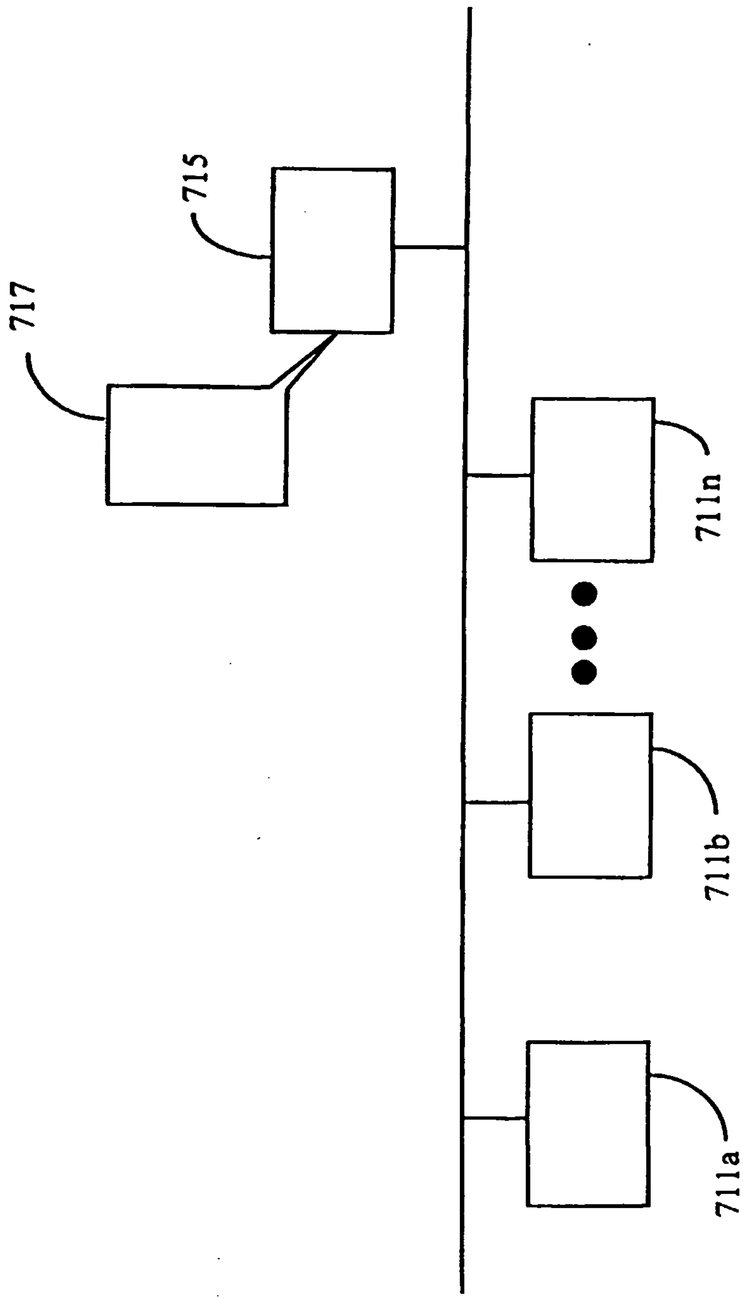


Fig. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 6295

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	WO 94 12969 A (OAKLEIGH SYSTEMS INC) 9 June 1994 * the whole document *	1-4,6	G06F1/32 G06F11/30
A	PATENT ABSTRACTS OF JAPAN vol. 095, no. 003, 28 April 1995 & JP 06 342384 A (FUJITSU LTD), 13 December 1994 * abstract *	1,3,4,6	
A	PATENT ABSTRACTS OF JAPAN vol. 098, no. 006, 30 April 1998 & JP 10 031536 A (NEC CORP), 3 February 1998 * abstract *	1,3,4,6	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

G06F

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 January 1999	BAILAS, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 98 30 6295

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- [ ] Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

- [ ] No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- [ ] All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

- [ ] Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

- [X] None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

  1-6

European Patent Office

LACK OF UNITY OF INVENTION SHEET B

Application Number
EP 98 30 6295

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-6

   System and method for setting time interval for monitoring inactivity of input peripherals in order to save power by placing the computer system monitor in standby

2. Claims: 7,8

   System and method for setting inactivity time intervals in a plurality of computers in a computer network

3. Claims: 9,10

   System and method for initiating power management in a computer of a computer network system

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 30 6295

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-01-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9412969 A	09-06-1994	US 5389952 A	14-02-1995
		DE 672285 T	14-03-1996
		DE 678843 T	19-09-1996
		EP 0672285 A	20-09-1995
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		EP 0865018 A	16-09-1998
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		US 5648799 A	15-07-1997
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82